APHIS Technical Brief

Veterinary Services
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Risk Factors Associated with Clostridial Dermatitis on U.S. Turkey-grower Farms

Introduction

A disease of turkeys and broilers, clostridial dermatitis (cellulitis/gangrenous dermatitis) has become an issue of concern in recent years. In 2010, the U.S. Animal Health Association (USAHA) ranked clostridial dermatitis among the top three disease issues in turkeys (USAHA, 2010). The disease causes mortality with necrosis, edema, and/or gas in the subcutaneous tissues, and most often affects toms 13 to 18 weeks old.

In December 2008, a Gold Medal Panel of industry experts was assembled to identify research needs and discuss clostridial dermatitis. Several measures to control or stop the disease were discussed:

- Removing dead birds from barns at least two to three times per day,
- Keeping litter dry,
- Feeding probiotics/direct-fed microbials,
- Barn cleanout including litter removal after an affected flock,
- Acidifying litter,
- Acidifying birds' drinking water,
- Adding iodine to birds' drinking water,
- In-barn composting of litter between flocks (windrow composting),
- Minimizing bird stress,
- Adding extra vitamin E to feed, and
- Increasing barn space allocated for birds (decreased stocking density) (Clark, 2010).

Most of these measures are aimed at decreasing the bacterial load in the barn and/or changing environmental conditions to be less favorable for clostridial growth.

Methodology

The U.S. Department of Agriculture's National Animal Health Monitoring System (NAHMS) conducted a study to determine risk factors associated with clostridial dermatitis on U.S. turkey farms. For the study, 15 of the Nation's largest turkey companies were selected to participate. The selected companies represented 76.8 percent of turkeys slaughtered in the United States in 2009 (WATT, 2010). Ten of the 15 selected companies agreed to participate in the study.

Participating companies selected case and control farms based on the following definitions provided by NAHMS:

- **Case farm:** farm in which at least two-thirds of flocks placed were affected with clostridial dermatitis during the previous 12 months. An affected flock was one in which mortality due to clostridial dermatitis was greater than 0.5 per 1,000 birds for 2 consecutive days.
- **Control farm:** farm with little or no problem with clostridial dermatitis during the previous 12 months.

Questionnaires were completed for 36 case farms and 35 control farms between June 3 and December 17, 2010. Questionnaire data were analyzed to look for statistical associations between farm status (case vs. control) and farm characteristics, such as management practices.

Results

Risk factors found to be associated (p-value <0.05) with clostridial dermatitis included:

- Composting litter within 200 feet of a poultry barn,
- Soil pH immediately outside of barn of 6.0 or higher, and
- Humidity level 60 percent or higher in the barn (figure 1, table 1).

In addition, requiring employees to scrub footwear was associated with a reduced risk of clostridial dermatitis. The questionnaire did not collect information on in-barn windrow composting of litter, only on litter composting that occurred in a location outside the poultry barns.

Figure 1. Percentage of case farms and control farms with the following characteristics

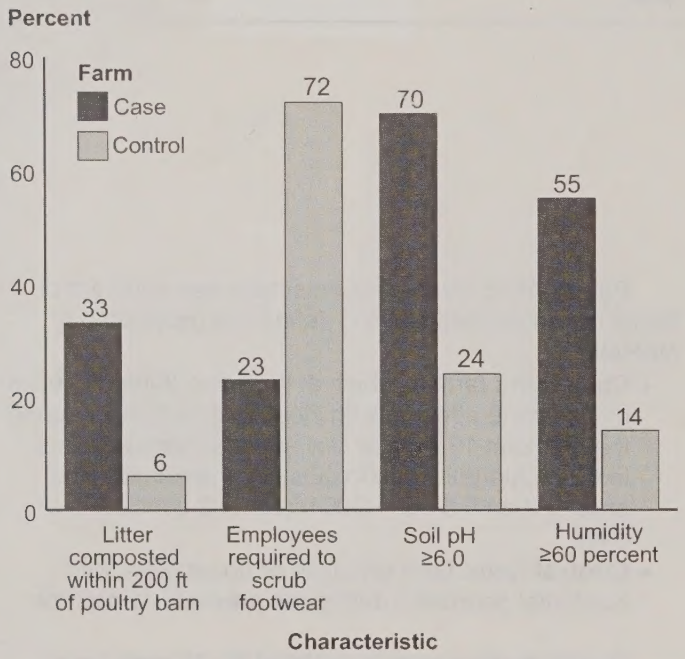


Table 1. Results of logistic regression for factors associated with being a clostridial dermatitis case farm

Factor	Odds ratio	p-value
Litter composted within 200 ft of poultry barn[1]	8.3	0.01
Employees required to scrub footwear (bucket and brush)[1]	0.09	0.0004
Soil pH ≥6.0[2]	17.5	0.02
Humidity ≥60 percent[2]	11.6	0.02

[1]Adjusted for region.
[2]Adjusted for region and season.

Case farms were less likely to require employees to scrub footwear compared with control farms (OR=0.09; table 1). This finding suggests that clostridial organisms from other locations on the farm might be transported and introduced to the poultry barn by employee footwear. Most of the farms that did not require employees to scrub footwear used a different footwear precaution, such as dry or liquid footbaths. Scrubbing footwear with a bucket and brush, and thereby reducing microbial contamination from boots, might be more effective than dry or wet footbaths. Based on this study, scrubbing footwear is recommended to help prevent or control clostridial dermatitis.

Litter management is thought to be an important component of clostridial dermatitis control. This study found that case farms were more likely than control farms to compost litter within 200 feet of poultry barns (OR=8.3; table 1). Control farms were more likely to compost litter more than 200 feet from poultry barns or not compost litter at all. The proximity of the composting shed to the poultry barns was the important factor, not whether litter was composted on site.

It is unclear why having a composting shed in close proximity to the poultry barns is associated with being a case farm. *Clostridium septicum* is thought to be the principal cause of clostridial dermatitis (Tellez, 2009). Litter from an affected flock is likely to have a high number of *C. septicum* spores. Some farms also compost dead birds along with litter, which may increase the clostridial load. In theory, *C. septicum* could be carried mechanically from the composting shed to the poultry barns by people, rodents, or insects. Airborne spread of some clostridial species has also been reported (Pillai et al., 1996; Chai et al, 1997; Best et al., 2010; Keessen et al., 2011). *C. septicum* could be disseminated by airborne routes as well, but further research is needed to determine how far spores can travel when airborne.

Case farms had significantly higher humidity levels in the poultry barns and higher soil pH than control farms (figure 1). Perhaps the association between high humidity and clostridial dermatitis is related to increased litter moisture. However, litter moisture was not measured in this study. Higher soil pH (≥6) may be favorable to clostridial organisms since they prefer a pH of 6 to 7 for optimal growth and toxin production.

Certain factors believed to be important to clostridial dermatitis control were not found to have a statistically significant association with farm status (case vs. control) in this study. For example, the following variables were analyzed but not found to be statistically significant:

- Frequency of mortality removal
- Use of a cull pen
- Barn cleanout practices
- Litter tilling
- Dead bird disposal by composting.

If case farms changed their practices in response to disease, this may have affected the study's ability to detect an association between the practice and being a case farm. Therefore, the study findings did not refute the importance of these practices for the control or prevention of clostridial dermatitis. A prospective study or a clinical trial could be used to further analyze these practices. However, clinical trials are costly and time consuming.

To further investigate risk factors for clostridial dermatitis, another analysis was performed using the last completed flock on each of the 36 case farms. This analysis compared flocks that had mild or minimal clostridial dermatitis with flocks with moderate or severe clostridial dermatitis, to evaluate interventions used on case farms. The following definitions for the severity of clostridial dermatitis were used:

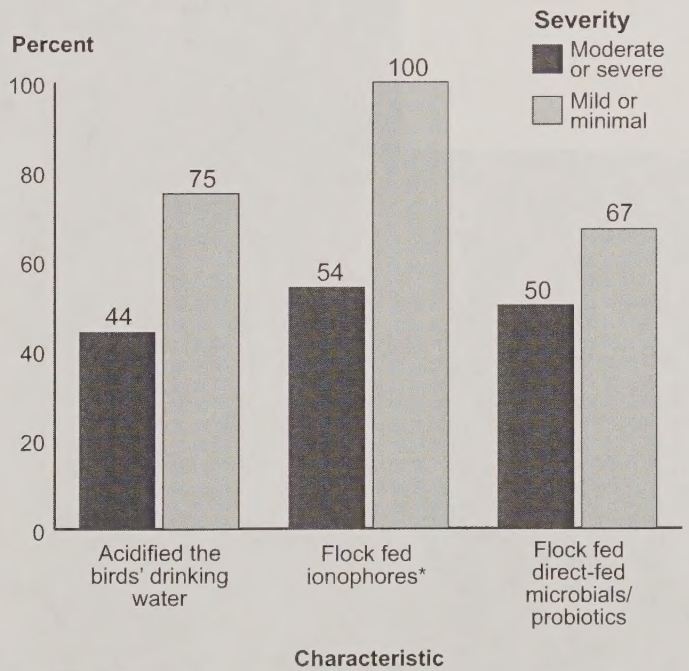
- Mild = not treated
- Minimal = treated once and responded
- Moderate = multiple or continuous treatment, responded
- Severe = no or poor response to treatment

Due to the small sample size, and because three-fourths of case farms had a moderate to severe clostridial dermatitis problem, establishing reliable statistical associations was not possible. However, a few variables were interesting numerically: water acidification, use of direct-fed microbials, and use of ionophores.

A lower percentage of moderately to severely affected flocks had received acidified water or direct-fed microbials compared with mildly or minimally affected flocks (figure 2). This finding is in agreement with the belief that acidification may help control or prevent this disease by creating conditions that are less favorable for clostridial growth. Similarly, direct-fed microbials alter gut flora and may cause a competitive inhibition of clostridial growth in the gut.

In addition, an apparently lower percentage of moderately to severely affected flocks than mildly or minimally affected flocks had received ionophores. This result was unexpected. The questionnaire did not collect information on timing or duration of administration of ionophores. These intervention strategies deserve further investigation in future studies.

Figure 2. Percentage of case farms with the following characteristics, by severity of clostridial dermatitis in the last completed flock



*Includes Coban and Avitec coccidiostats.

Summary

The NAHMS study verified that high environmental humidity and high soil PH contribute to clostridial dermatitis and identified two measures that might aid in the prevention or control of clostridial dermatitis: footwear scrubbing by employees and keeping litter composting sheds more than 200 feet from poultry barns.

Water acidification and administering direct-fed microbials or ionophores may be effective in reducing the severity of clostridial dermatitis on affected farms, but further research is needed in this area.

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